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REPORT OF THE SURVEYS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST
1934

By
Archie L. Gibson
Assistant Entomologist

Copies to:

- Dr. Craighead, Washington, D.C.
- The Forester, " " "
- F. P. Keen, Portland, Ore.
- J. M. Miller, Berkeley, Cal.
- J. A. Beal, Denver, Col.
- Regional Forester, Missoula, Mont.
- Regional Forester, Ogden, Utah
- Forest Supervisor, Beaverhead Nat'l Forest, Mont.
- Mr. Coffman, Park Service, Washington, D.C.

Forest Insect Laboratory
Coeur d'Alene, Idaho
March 12, 1935

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-1934-

Respectfully submitted,

Archie L. Gibson

Archie L. Gibson
Assistant Entomologist

Forest Insect Laboratory
Coeur d'Alene, Idaho
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REPORT OF THE SURVEYS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST

1934

Introduction

Although the data for the Beaverhead Forest have already been presented in the report of the Yellowstone Project, this report has been prepared in order that the more detailed discussion of conditions on the various parts of the forest and other phases of the study might be understood more clearly.

The Present Status of the Beaverhead Infestation

The survey data included in this report are for the region within the old boundary of the Beaverhead National Forest and the small area of public domain in the Sheep Canyon Hills about 10 miles South of Dillon, Montana.

Although many units continued to show an increase, the 1934 data indicate a general increase in the mountain pine beetle infestation, owing to the decided increases in the eastern, more recently invaded units of the old Beaverhead Forest. Apparently very little acceptable host material is now available on the units in the western portion of the forest as the outbreak is rapidly subsiding. Only one unit bordering the Big Hole Basin showed an increase, the Warm Springs Unit. The status of the general infestation for the period of the surveys is as follows:

CHANGES IN MOUNTAIN PINE BEETLE INFESTATION
BEAVERHEAD NATIONAL FOREST

Number of Attacked trees in:							
1927	1928	1929	1930	1931	1932	1933	1934
67,691*	722,504	3,119,542	4,898,326	15,402,520	17,586,171	869,647	1,282,510
Increase:	654,813	2,397,038	1,778,784	10,504,194	2,183,651	---	412,863
Decrease:	---	---	---	---	---	16,716,524	

*Estimate considered to have been too conservative; also, 55,045 of these trees were treated in 1928. All data subsequent to 1927 corrected for effect of differences in date of survey on total infestation.

Although the preceding figures indicate that the infestation is again increasing, it must not be construed as indicating that the outbreak will again reach its former severity. There is apparently insufficient acceptable host material over the forest as a whole to support such an increase. On the eastern part of the forest the recently invaded units will probably show increases for a few years followed by a decrease when host material becomes scarce.

In Table I may be seen a summarization of losses on each unit. Only the total of attacked trees is shown for the period from 1927 to 1930 and annually subsequent to that time.

Table I.

SUMMARY SHEET - BEAVERHEAD FOREST SURVEY - 1934

COMPARISON OF INFESTATION FROM 1927 - 1934 CAUSED BY THE MOUNTAIN PINE BEETLE IN LODGEPOLE PINE

Unit	Acreage	Estimated Number of Attacked Trees				
		1927-30	1931	1932	1933	1934
Pintlar	61,600	1,050,379	762,465	667,732	37,167	10,651
Mussigbrod	56,300	1,150,910	1,336,675	1,424,904	12,085	7,848
Battlefield	102,400	2,514,804	4,445,696	2,471,203	37,895	8,179
West Side	76,500	963,165	2,031,534	1,468,693	52,129	25,574
Jackson	75,800	976,351	1,404,498	1,730,767	51,279	16,191
Bloody Dick	108,160	569,470	1,551,339	2,796,036	55,603	34,744
Horse Prairie	57,000	248,653	167,124	93,525	32,092	33,425
Rattlesnake	68,400	29,431	117,990	513,334	63,915	220,487
Grasshopper	42,500	18,646	91,587	574,034	12,455	52,395
Warm Springs	54,500	245,376	1,135,856	1,736,678	42,241	63,310
East Side	86,200	824,789	1,519,783	660,867	13,403	13,298
Upper Wise River	142,800	60,578	408,694	1,166,162	150,316	243,945
Lower Wise River	59,000	106,746	231,068	893,323	133,578	134,856
Melrose	132,700	10,368	134,847	1,182,491	110,919	391,757
Lime	218,000	27,751	63,344	206,422	64,570	25,850
TOTALS	1,341,860	8,795,417	15,402,326	17,586,171	869,647	1,282,510

Inspection of the preceding table indicates only five of the fifteen units are responsible for the major portion of the 1934 increase in the infestation. Two other units show only negligible gains, one a slight reduction, and seven a very decided decrease. A better idea of the status of the infestation on each unit may be secured by some readers from the tree per acre figure rather than the total per unit, therefor, the total losses per acre for the period from 1927 to 1930 and annual losses with percent change in status are given in Table II.

Table II

COMPARISON OF ATTACKED TREES PER ACRE AND PERCENT OF INCREASE EACH YEAR FOR PERIOD 1927 to 1934
BEAVERHEAD FOREST SURVEY OF MOUNTAIN PINE BEETLE IN LODGEPOLE PINE - 1934

	1927-1930	1931		1932		1933		1934		
UNIT	Total att. trees per acre	Att. trees per A.	% change over Prev. yr	Att. trees per A.	% change over prev. yr	Att. trees per A.	% change over prev. yr	Att. trees per A.	% change over Prev. yr	Total trees killed per acre by Dm.
Pintler	17.40	12.38	70.4	10.08	-18.5	.60	-94.0	.17	-71.3	40.64
Mussigbrod	20.83	23.74	152.8	25.32	6.7	.22	-99.2	.14	-35.1	70.25
Battlefield	24.60	43.42	153.3	24.13	-44.4	.37	-98.5	.08	-78.4	92.60
West Side	12.59	26.56	279.9	19.21	-27.7	.68	-96.5	.33	-50.9	59.37
Jackson	12.95	18.52	150.8	22.84	23.3	.68	-97.0	.21	-68.4	55.19
Bloody Dick	5.27	14.34	360.2	25.85	80.3	.51	-98.0	.32	-37.5	46.30
Horse Prairie	4.36	2.93	387.9	1.64	-44.0	.56	-65.7	.59	4.1	10.09
Rattlesnake	.43	1.72	1301.6	7.50	335.3	.93	-87.6	3.22	245.0	13.82
Grasshopper	.42	2.16	545.2	13.52	527.4	.34	-97.5	1.23	320.7	17.67
Warm Springs	4.50	20.85	793.8	31.88	52.9	.78	-97.6	1.16	49.9	59.17
East Side	9.75	17.63	251.3	7.67	-56.6	.06	-99.2	.15	- .8	35.26
Upper Wise River	.42	2.86	1406.3	8.17	185.3	1.05	-87.1	1.71	62.3	14.21
Lower Wise River	1.81	3.92	236.4	15.13	286.5	2.26	-85.0	2.29	1.0	25.41
Melrose	.08	1.02	1203.8	8.91	776.4	.84	-90.6	2.95	253.2	13.80
Lime	.13	.29	385.0	.95	225.4	.30	-68.7	.12	-60.0	1.78
Totals & Ave.'s	6.60	11.48	214.5	13.11	14.2	.65	-95.1	.96	78.3	32.79

The comparatively light losses shown by some units are not a true picture of conditions. For example, a very small proportion of the Lima Unit is timbered which places the loss per acre at a very low figure. However, in the widely scattered patches of susceptible timber, the proportion of trees killed seems to be just as heavy as in the large continuous stands of timber.

The losses shown in the preceding tables represent only those trees killed by the mountain pine beetle. Secondary insects, of which the most numerous were *Pityogenes knechtelii*, *Pityophthorus burkei*, and *Ips oregoni*, also took a heavy toll in 1933 and 1934. In 1933, if data from the three check strips may be considered representative, secondaries were responsible for over 53 percent of the timber killed, ? or more than the amount killed by the mountain pine beetle. In 1934, the differences were even greater, with the mountain pine beetle responsible for the death of only about 15 percent of the trees killed. Therefore, if the 869,647 trees killed in 1933 were only 47 percent of the total trees attacked, 988,558 trees were killed by secondaries in 1933. In the same way, if the 1,262,510 trees killed by the mountain pine beetle are but 15 percent of the total attacked, 7,383,098 were killed by secondaries, making a total of 8,665,608 for 1933 and 1934, or an average of 6.458 trees per acre for the entire forest for these two years. The results of the repeated surveys in 1934 of the barkbeetle activity on the three check strips is shown in detail in the discussion which follows.

Battlefield Check Strip

The data from the Battlefield check strip indicate that losses from the mountain pine beetle have now decreased to where they are negligible. The nine attacked trees found on the strip gave an average of only .25 trees per acre for the 36 acres and only one of the nine trees was killed. Secondary insects have continued to kill many trees but a decided decrease in their activity in the latter part of the summer in this general area leads the writer to believe that they too will cease to cause much loss subsequent to 1934. Owing to the decided difference in the character of secondary bark-beetle attacks, the data from the Battlefield check strip have been plotted separately on Chart I from that of the other four check strips. To more readily picture conditions, the data are given in tabular form.

Table III
Trees Attacked on the Battlefield Check Strip by
Bark Beetlesup to and Including 1934

	Total		Per Acre	
Killed by Dm.	6,106		169.6	
Killed by Ips sp.* & Dm.	903		~~27.9~~ 25.1	
Killed by Ips sp.*	1,366		38.0	
Total		8,375		~~235.5~~ 232.7
Trees with green side following Dm. attack	726		20.2	
Trees which have "Pitched out" Dm. attacks	2,401		~~67.2~~ 66.7	
Trees which have "Pitched out Ips sp. attack	17		.5	
Total		3,144		~~87.9~~ 87.4
GRAND TOTAL		11,519		~~323.4~~ 320.0

*Includes all secondary bark beetles in this and subsequent tables.

The preceding figures indicate how heavy the losses have been on the average acre of the check strip. Trees attacked but still having a green side, although of some value in reseeding the area, have no future timber value and could be classed with the killed trees, making a total of 255.7 trees destroyed per acre. The other trees, although attacked, are not sufficiently damaged to prevent their use as timber.

Such heavy losses raise the question of what stand remains on the area. Table IV gives the stand per acre before and after the infestation. Pitched-out trees are those which have successfully resisted bark-beetle attack and are little, if at all, damaged.

Table IV.
Battlefield Check Strip
Stand of Lodgepole Pine per Acre

DBH Classes	2	4	6	8	10	12	14	16	18	20	22	Total	% original stand	Sq.ft. basal area	% original basal area	Average DBH
Prior to Infestation	547.94	274.33	179.08	06 123.07	52.03	17.06 ~~14.06~~	9.50	1.06	.81	-	.03	1204.89	97.2	168.89	97.0	4.3
At end of '34: Green	539.11	244.33	72.50	24.31	4.67	--	--	--	-	-	-	884.92	71.4	58.35	33.5	3.1
Pitched out	.17	.28	35.33	30.42	.89	--	,08	--	-	-	-	67.17	5.5	18.16	10.5	7.0
Other Species	18.25	7.23	3.36	2.67	1.37	.28	.25	--	-	.28	.25	33.94	2.8	5.12	3.0	4.1
Grand total Living trees Per acre	557.53	251.84	111.19	57.40	6.93	.28	.33	--	-	.28	.25	986.03	79.6	81.63	47.0	3.4

Data in the preceding table indicate that there is an average of 986 trees per acre left on the strip. These represent nearly 77 percent of the number of trees on the area prior to the outbreak. Numerically, the loss has been small, but considered on a basal area, only 47 percent of the original stand remains. If the remaining trees were uniformly distributed as to diameter classes over the entire area, they would provide ample stocking for a future stand. However, this condition does not exist and many areas which had a heavy stand of the larger diameter lodgepole pine have been depleted to the point where very few living trees remain. In contrast with this, there are many areas of young timber on which too few trees have been killed to remedy a heavily overstocked condition of the stand.

Although the secondary insects have killed a great many trees, their activity has not always been detrimental. Their preference seems to be for the weakened trees and in the removal of suppressed, wind-bowed, broken-topped, porcupine-injured and diseased trees from the stand, they perform a beneficial thinning operation. In addition to removing the above class of trees, they improve overstocked stands if they do not kill too many trees on a given area. Data was not kept on the proportion of detrimental and beneficial activity by secondary insects, but it is believed at least 20 percent of it has been of advantage to the stand on the Battlefield strip.

Owing to the small number of trees attacked by the mountain pine beetle and the restriction of the period of attack to such a short time, only the data from the Wise River and Elkhorn strips have been used in the preparation of a correction factor to determine the proportion of total attacks present at certain times during the summer.

Wise River Check Strip

The Wise River strip is intermediate between the Elkhorn and Battlefield strips in the matter of losses from the mountain pine beetle infestation. This strip also has a different stand composition in that species unsusceptible to barkbeetle attack comprise more than 25 percent of the number of trees and nearly 35 percent of the basal area of the original stand. It is hoped that this strip will indicate the effect of a mixed stand upon a mountain pine beetle infestation. The destruction resulting from the infestation is shown in the following tabulation.

Table V.
Trees Attacked on the Wise River Check Strip by
Bark-Beetles up to and Incinding 1934

	Total		Per Acre	
Killed by Dm.	1.564		39.1	
Killed by Ips & Dm.	251		6.3	
Killed by Ips sp.	468		11.7	
Total	2.283	2,283	57.1	57.1
Trees with green side following Dm. attack	11		.3	
Trees which have "Pitched out" Dm. attack	137		3.4	
Trees which have "pitched out" Ips attack	--		--	
Total	148	148	3.7	3.7
GRAND TOTAL		2,431		60.8

The data in the preceding tabulation show not only a heavier loss per acre on this unit compared with the Elkhorn area, but that a much larger percentage of the susceptible timber has been killed. Already 11.6 percent of the total number of lodgepole pine and 39.1 percent of the basal area of that timber species has been killed by bark beetles. A striking and unaccountable difference in the activity of insects on the two strips is the relatively small amount of loss caused by secondary insects when compared with the heavy toll they have taken on the Battlefield and Elkhorn areas. This is even less understandable when it is realized that the infestation on the Wise River area is of longer standing than that on the Elkhorn strip and our experience on the Battlefield area indicates the ratio of secondary to primary insect losses increases as the period of infestation lengthens.

The status of the timber on the Wise River strip is shown in the succeeding table VI which is similar to Table IV and VIII for purposes of comparing.

Table VI.
Wise River Check Strip
Stand of Lodgepole Pine per Acre

DBH Classes	2	4	6	8	10	12	14	16	18	20	22	24	26	Total	% original stand	Sq.ft basal area	% original basal area	Average DBH
Prior to Infestation	15 213.2	43 176.4	35 55.4	85 46.8	0 14.6	05 10.5	07 5.1	78 .8	.7	--	--	--	--	522.98 523.0	74.4	70.9	65.3	4.2
At end of '34 Green	208.3	172.2	47.3	28.5	3.7	7 ~~1.1~~	.9	.1	.2	--	--	--	--	462.3	65.7	43.1	39.8	3.6
Pitched out	--	.1	.9	1.5	.4	.5	-	.02	--	--	--	--	--	3.4	.5	1.4	1.2	8.2
Other Species	70.8	50.7	24.9	9.8	6.4	8.1	4.6	3.3	.7	.4	--	.2	.2	180.1	25.6	37.4	34.7	4.9
Grand total living trees Peracre	279.1	222.9	73.0	39.8	10.5	9.3	5.5	3.4	.9	.4	--	.2	.2	645.8	91.8	81.9	75.6	4.0

Final conclusions as to the effect of unsusceptible timber species in mixture with tree species subject to attack by the mountain pine beetle cannot be made until there is no longer infestation on the area. However, indications up to the present time are that unsusceptible species in mixture with susceptible species offer no protection to the susceptible trees from mountain pine beetle attack under conditions such as are present on this strip.

The period of attack and the amount of attack present on different dates on both the Wise River and Elkhorn strips show no material differences. The data from them is plotted on Chart I appended to this report.

Elkhorn Check Strip

To facilitate comparison, the data for the Elkhorn check strip have been presented in the same manner as those of the Battlefield strip. It must not be assumed, however, that the stand on the Elkhorn strip has reached the same status in regard to the infestation as the stand on the Battlefield check strip. Direct losses from bark beetles will probably be negligible on the Battlefield area for a number of years, with the infestation continuing to decrease on that portion of the forest. In contrast , the outbreak has but recently reached the serious stage in the vicinity of the Elkhorn strip and, judging from what has happened on other areas, losses will continue until acceptable host material is exhausted or some unforeseen factor interferes.

The losses caused by the mountain pine beetle up to the present time are shown in the following tabulation.

Table VII
Trees Attacked on the Elkhorn Check Strip by
Bark Beetles up to and including 1934

	Total		Per Acre	
Killed by *Dm.*	681		18.9	
Killed by *Ips sp.* and *Dm.*	109		3.0	
Killed by *Ips sp.*	719		20.0	
Total		1,509		41.9
Trees with green side following *Dm.* attack	25		.7	
Trees which have "pitched out" *Dm.* attacks	82		2.3	
Trees which have "pitched out" *Ips sp.* attack	67		1.9	
Total		174		4.9
GRAND TOTAL		1,683		46.8

The data in the preceding tabulation indicate losses have been comparatively light on the Elkhorn strip up to the present time. On the basis of basal area, 53 percent of the timber has been destroyed per acre on the Battlefield area, whereas only 16 percent has been killed on the Elkhorn strip.

The data of the Elkhorn and Wise River strips also differ from the Battlefield data in that the former two indicate secondary insects were active during practically the entire summer of 1934, whereas on the Battlefield strip few attacks occurred subsequent to mid-August.

The trend of activity on the three strips is shown in Chart I appended to this report.

In order to place the data from all check strips on a more readily comparable basis, similar tables have been prepared for each which give the status of the stand before the infestation and at the present time. Table VIII depicts the Elkhorn strip.

Table VIII
Elkhorn Check Strip
Stand of Lodgepole Pine per Acre

DBH Classes	2	4	6	8	10	12	14	16	18	20	22	24	26	28	Total	% original stand	Sqpft. basal area	% original basal area	Average DBH
Prior to infestation	533.8	291.8	115.8	56.0	19.2	15.8	5.9	4.7	.5	.2	--	--	.2	--	1043.9	98.8	117.32	98.6	3.8
At end of '34: Green	524.1	286.7	109.9	48.6	12.0	10.0	2.9	3.0	--	--	--	--	--	--	997.2 ~~1022.2~~	94.3 ~~96.7~~	96.70	81.3	3.5
Pitched out	.4	.4	1.0	.9	.9	.2	.2	.1	--	--	--	--	--	--	4.1	.4	1.54	1.3	7.6
Other Species	8.9	3.6	.3	.2	.3	--	-	-	--	--	--	.1	-	.1	13.4	1.3 ~~1.2~~	1.62	.03	3.3
Grand total Living trees per acre	533.4	290.7	111.2	49.7	13.2	10.2	3.1	3.1	--	--	--	.1	--	.1	1014.7 ~~1039.7~~	96.0 ~~98.3~~	99.86	82.63	3.55

The discrepancies between the percentage figures for number of trees killed and their basal area is due to the fact that the trees killed are much larger than the average tree in the stand and consequently have a much larger basal area. This applies to all three check strips.

Status of the Infestation on Each Unit

In the following pages a more detailed discussion is given of the conditions on each unit. However, only the changes which have occurred in the last few years will be discussed as the earlier development of the infestation has been described in previous reports.

Since 1933 all but one unit bordering on the Big Hole Basin have shown more or less decrease in the amount of infestation. The exception has been the Warm Springs Unit which showed an increase in 1934. The other areas which are the Pintlar, Mussigbrod, Battlefield, West Side, Jackson and East Side Units all showed a decrease in 1934, and a study of the data from these units indicates that serious losses from the mountain pine beetle are past. Secondary bark beetles may continue to cause some loss, but if conditions in 1934 on the Battlefield area are typical, even they are decreasing in destructiveness.

It is apparent that up to the present time the Battlefield Unit has been depleted most heavily probably due to the almost unbroken stand of timber and consequent large number of trees per acre with the Mussigbrod Unit ranking next in severity of losses. All the units had practically a pure stand of lodgepole pine with a considerable range in diameter classes, which is now reduced to one where there are comparatively few living trees over six inches in diameter. In the future, indirect losses from the outbreak are likely to be governed by the number of insect-killed trees, which destroy more or less of the young timber in the path of their fall. Also, the dead timber has greatly increased the fire hazard which will probably persist for many years.

Of the three areas south of the Big Hole Basin and bordering the Salmon Forest, only the Horse Prairie Unit showed any increase and that may have been due to insects from the Idaho infestation. However, that increase was a very slight one and both the adjoining Bloody Dick and Lima Units showed decided decreases. Only a very small portion of the Lima Unit is timbered; usually consisting of more or less isolated patches in which there is a large proportion of unsusceptible species. Because of that condition, the loss per average acre has been comparatively light. However, within these stands, the bark beetles seem to have killed as large a proportion of the lodgepole pine as on the heavily timbered areas.

The Rattlesnake Unit showed a decided gain in the number of attacked trees in 1934 which is still, however, considerably below the number killed in 1932. Unless some unforeseen factor intervenes, annual increases may be expected on this and neighboring units until host material becomes scarce. Although some immigration of insects from the units to the southwest and west may occur, it is doubtful if they will greatly influence the development of the outbreak on this unit.

The Melrose Unit will probably continue to show increasing losses for a few years as it is the most recently invaded area. It also seems likely that nearby units to the south and west will contribute to the infestation on this unit when their supply of host material decreases. The adjoining Grasshopper and Upper Wise River Units also showed decided increases which will probably continue for a number of years. The Lower Wise River Unit showed only a slight gain in spite of a considerable supply of mature timber. It is possible the small amount of data for this unit were insufficient to furnish a representative sample.

General Status of the Beaverhead Infestation

An increase in infestation occurred on the units in the eastern part of the forest in 1934. Decreases occurred on practically all the remaining units and it seems unlikely that the present outbreak will build up on them again. The eastern units, however, may be expected to support an increasing outbreak for a few years unless some controlling factor intervenes. One such factor may be the secondary insects which showed a decided general increase in activity in 1934, in spite of a marked decline late in the season on the Battlefield area. The writer has observed many trees attacked by the mountain pine beetle "filled in" a short time afterward by these secondary insects. They, because of their shorter life cycle, consume the cambium upon which the larvae of the mountain pine beetle feed before the latter have completed their feeding stage. This results in the starvation of the mountain pine beetle larvae. Even though the cambium may not be entirely consumed by the feeding of the secondary larvae, it becomes so dry because of the numerous larval mines and entrance and emergence holes of the secondaries as to apparently decrease below the minimum moisture requirements for development of the mountain pine beetle larvae. Whatever the cause, it has been observed that little or no emergence of the mountain pine beetle occurs from lodgepole pine which is "filled in" in secondaries a short time subsequent to attack. The preceding discussion has been presented to show that the secondary insects may become an important control factor on the units on the eastern part of the forest if they continue to increase as they have in the past two years.

The Sheep Canyon Hills area of public domain a few miles south of Dillon supports an increase in mountain pine beetle infestation slightly less than the average for the Beaverhead Forest, due probably to decreasing host material. This area has suffered heavy losses and the remaining timber is chiefly of small diameter which offers considerable resistance to attack and to development of the mountain pine beetle brood. It seems unlikely that the infestation will increase materially on this area in the next year or two and may even decrease. The portion of the outbreak on the headwaters of Blacktail Creek is just getting well established again after the decrease in 1933. The number of attacked trees rose from 7,504 in 1933 to 37,954 in 1934. The outbreak on this area may be expected to increase for a few years, as there is ample timber favorable to bark beetle development. The status of the infestation in the Sheep Canyon and Blacktail Hills is shown on Table IX.

Table IX.
Status of the Mountain Pine Beetle Infestation on the Blacktail Creek Drainage from 1930 - 1934

	Acreage of area	No. trees treated in 1931(1)	Probable No. trees left 1931(1)	Trees Attacked			
				1931	1932	1933	1934
Sheep Canyon	23,680	3,045	500	23,183	151,000	14,858	22,978
East Fork Blacktail	12,800	641	200(3)	2,050	8,232(6)	3,077	20,170(8)
Middle Fork Blacktail	3,520	196	--	350	--	1,191	---
West Fork Blacktail	19,840	971	250(2)	3,200	11,085(5)	1,782	17,784(9)
Clover, Wolverine, West & Middle Creeks	5,140	--	--	1,375(4)	--	131	--
Little Basin Creek	4,480	--	--	--	--	1,323	--
TOTALS	69,460	4,853	950	30,158	170,317	22,362(7)	60,932

(1) 1930 attack. (2) Includes one group of 45 trees. (3) Includes large untreated area. (4) Included in West and East Forks in 1930. (5) West Fork and Middle Fork data. (6) Clover, Wolverine, West and Middle Creeks data included. (7) Total for all but Sheep Canyon, 7,504. (8) Includes Wolverine, West and Middle Creek data. (9) Includes Middle Fork Blacktail, Clover Creek and Little Basin Creek data.

Data Concerning Administration of the Survey

The area of the strips run on the Beaverhead National Forest in 1934 amounted to .42 of one percent of the total area of the forest covered by the survey, as compared with .51 for 1933, .45 for 1932, .87 for 1931, and .69 for 1930.

Cost of survey increases slightly due to higher salary and subsistence costs.

Data concerning the administration of the survey are given in Table X.

Table X
Summary and Analysis of Beaverhead National Forest Survey - 1934

	Man-days on Project				
Items	Unit Strip(1)	Check Strip	Office	Ineff.	Total
Man-days spent on survey	80	9	21	48	158
Miles of sample strip					740.8
Miles of strip per man-day	9.26				
No. sample strip acres	5926.8				
No. sample strip acres per man-day	74.1				
Acres covered by survey					1,415,340
Acres covered per man-day	17,692				

Total cost of survey:

Labor	$ 705.15	$149.52	854.67
Transportation	77.72		77.72
Subsistence	242.48		242.48
	$1025.35	$149.52	$1174.87

Cost of Survey Distributed:

Cost per man-day	7.44
" " mile of strip	1.59
" " sample acre	.198
" " acre of region surveyed	.00083
Percent of total area ~~not~~ actually covered by survey	.42

(1) Consists only of the amount of strip run on the units to determine the amount of infestation.

Analysis of ineffective time:

Sundays	13
Rain & snow	6
Travel	20*
Compensatory time	5
Holiday	4

*15 to and from project; 5 on project.

Summary

The outstanding findings of the 1934 survey were as follows:

1. An increase in the number of trees attacked by the mountain pine beetle from 869,647 to 1,282,510 in spite of the fact that eight of the fifteen units showed a decrease while only seven showed a gain.

2. Evidence that secondary insects destroyed more trees in 1934 than in 1933.

3. Indications that losses from the mountain pine beetle will continue to decrease on the units bordering the Big Hole Basin.

4. Indications that the infestation will increase on the units in the eastern part of the forest.

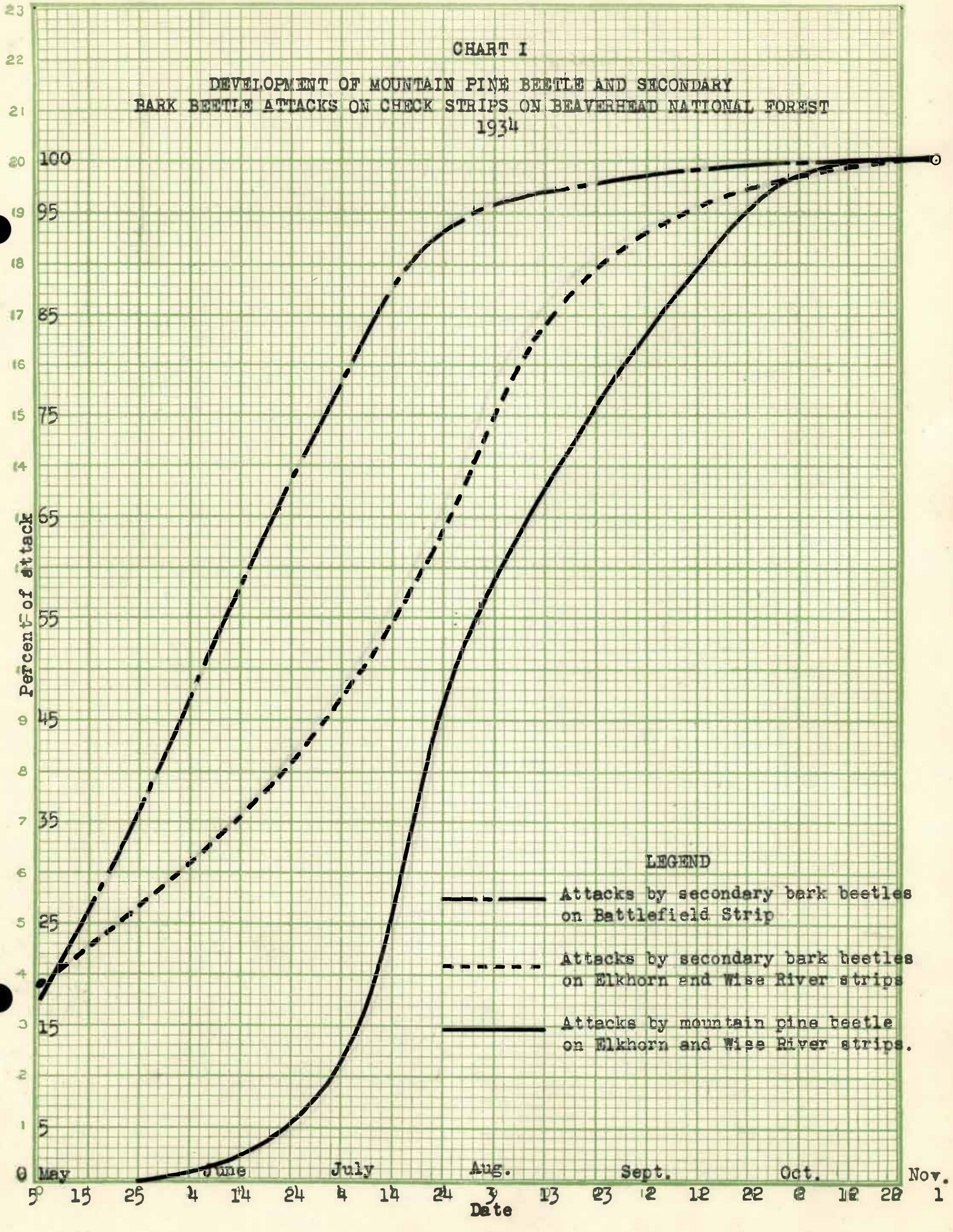

CHART I

DEVELOPMENT OF MOUNTAIN PINE BEETLE AND SECONDARY BARK BEETLE ATTACKS ON CHECK STRIPS ON BEAVERHEAD NATIONAL FOREST 1934